Future envisioned missions to deep space elicit problems and challenges not fully investigated by the world’s spaceflight organizations. One of the most prominent issues is prolonged exposure to weightlessness. The human body functions day-to-day with the resistance and force of gravity; in the absence of this phenomenon, bones/muscles swiftly atrophy. Another alarming effect, which has been acknowledged in recent years, is loss of vision due to prolonged spaceflight. Researchers hypothesize that lack of gravity increases pressure on the optic nerve, thus causing vision loss. An effective way to generate a force similar to gravity is to rotate a body to produce centrifugal force. For a small scale investigation of this concept, the Oklahoma State University Space Cowboys team has designed an inflatable beam-rotating experiment. The effects of various internal pressures on the beam’s stiffness and rotational stability will be examined. Inflatable structures are lightweight, have a high ratio of deployed to packed volume, and could provide sufficient support for a rotating spacecraft that produces an artificial gravity force. The experiment is designed to allow the deployment pressure to be altered between test runs (parabolas). As spaceflight becomes more ambitious and missions of longer duration become both desirable and possible, spacecraft designs must provide crew members with an Earth-like gravity environment.

The Oklahoma State University Space Cowboys hypothesize there is a correlation between deployment pressure and beam stiffness that in turn produces stable rotation. Each test will fix a defined inflation pressure. A near constant acceleration criteria, along with advanced motion tracking methods, will be used to quantify the optimal inflation pressure that produces inflatable beams that resist wrinkling when rotating. The team expects that there will be a measurable difference between the pressure required to induce wrinkling during ground tests and in 0-g. Ground tests in 1-g will be performed with the same pressures to be examined during actual flight testing so that the differences between the two environments can be compared.

Despite whether or not the hypothesis is correct, there are significant findings either way. Not only does the experiment prove/disprove relatively new ideas, but it also refines requirements for future spacecraft.